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## The DASH Diet, 20 Years Later

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This year marks the 20th anniversary of the publication showing the blood pressure–lowering effects of the Dietary Approaches to Stop Hypertension (DASH) diet.<sup>1</sup> The DASH diet is considered an important advance in nutritional science. It emphasizes foods rich in protein, fiber, potassium, magnesium, and calcium, such as fruits and vegetables, beans, nuts, whole grains, and low-fat dairy. It also limits foods high in saturated fat and sugar.<sup>1</sup> DASH is not a reduced-sodium diet, but its effect is enhanced by also lowering sodium intake.<sup>1</sup> Since the creation of DASH 20 years ago, numerous trials have demonstrated that it consistently lowers blood pressure across a diverse range of patients with hypertension and prehypertension.

The initial DASH trial was a 4-site, randomized controlled feeding study. Compared with a control diet typical of US consumption, the DASH diet produced reductions in systolic blood pressure (SBP) and diastolic blood pressure (DBP) of 5.5 and 3.0 mm Hg, respectively—with results evident as early as 2 weeks after baseline.<sup>1</sup> Blood pressure changes were observed in subgroups of men, women, racial/ethnic minorities, white individuals, and both hypertensive and prehypertensive participants.<sup>1</sup> DASH was particularly effective for those with hypertension (SBP and DBP change: –10.7 and –4.7 mm Hg, respectively) and among black individuals (SBP and DBP change: –6.8 and –3.7 mm Hg, respectively).<sup>1</sup> Because of this strong evidence, DASH has been a consistent part of national blood pressure and dietary guidelines since its original publication.<sup>2</sup>

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Yet adherence to DASH on a national level is poor. A decade-old analysis of data from the National Health and Nutrition Examination Survey (NHANES) showed that less than 1% of the US population was fully adherent to DASH in 1988 to 2004, and only 20% met half of the recommended levels of nutrients in DASH.<sup>3</sup> Analyses using more recent NHANES data from 2007 to 2012 showed similarly poor adherence; the average DASH adherence score was 2.6 of a possible 9.<sup>4</sup> The public health significance of poor DASH adherence cannot be overstated. Of the 80 million individuals in the United States with hypertension, only half have controlled blood pressure.<sup>5</sup> Hypertension is a primary risk factor for heart disease and stroke, 2 of the leading causes of death in the United States. A major public health challenge continues to be the broad dissemination and translation of DASH.

Achieving this goal first requires understanding the potential determinants of poor DASH adherence. At the environmental level, poor DASH adherence may be attributed to the current US food environment. Energy-dense, nutrient-deficient foods are highly accessible and inexpensive. Fruits and vegetables tend to be more expensive than other foods that can be purchased at fast-food restaurants. This is particularly true for low-income individuals who may reside in areas where DASH foods are less accessible. Despite these barriers, research has shown that DASH can be adopted at low cost and among low-income individuals<sup>6</sup>; foods such as dried beans or frozen vegetables are inexpensive and DASH accordant. Changing the food environment is a challenging task that will require changes at the community and policy levels. In the meantime, to improve adoption of DASH, efforts should focus on how individuals can work within their environments to improve their diets.

At the clinical level, primary care clinicians have an opportunity to provide counseling about dietary behaviors for hypertension management. Yet clinicians consistently report that limited time, knowledge, and perceived efficacy are barriers to dietary counseling. Moreover, many clinicians still primarily (or exclusively) recommend reducing sodium intake for hypertension control.<sup>7</sup> The extent to which primary care clinicians, who are responsible for the management of most patients with hypertension, are familiar with DASH is unknown.<sup>7</sup> In contrast, registered dietitians are well suited to provide counseling. Improving reimbursement coverage for registered dietitians could improve their reach.

At the individual level, innovative strategies are needed to induce sustainable behavior change. An emerging strategy to improve patient self-management is the use of digital health tools. Most US adults own a mobile phone and 77% have smartphones.<sup>8</sup> High rates of mobile phone and smartphone ownership extend to historically disconnected populations: rural, low-income, and racial/ethnic minority groups.<sup>8</sup> Because mobile devices are almost ubiquitous, they pose a unique opportunity to reach the highest-risk populations. Many apps and devices are available in the marketplace that explore how best to provide data that can be useful for lifestyle change and patient self-management.

Yet a limited number of tools are truly evidence based. Some investigators have developed evidence-based apps that are effective and promote high engagement. For instance, Burke et al<sup>9</sup> found that a digital weight loss intervention was superior in both self-monitoring engagement and weight loss compared with a nondigital approach. However, these research-based programs do not have the same reach as commercial products. It may be that

researchers need to investigate how to integrate evidence-based approaches into the industry's publicly available tools to accelerate translation and heighten effectiveness. In the case of DASH and digital approaches to health, research findings have not penetrated the commercial market. This is because few research studies have examined how to best deliver DASH through digital health tools. To truly disseminate DASH will require better understanding about how to harness tools that almost all people in the United States already have in their pocket right now.

The DASH diet represents a potentially affordable and scalable intervention that could almost immediately produce considerable improvements in population health. However, innovative strategies are necessary to determine how best to minimize the barriers to its widespread dissemination. The potential benefits of promoting DASH are substantial. As a study from 2003 suggested, if individuals with hypertension were fully adherent to DASH, an estimated 400 000 cardiovascular disease events could be prevented over 10 years.<sup>10</sup> This may be an overestimate given the reduction in cardiovascular disease events that has occurred during the past 14 years. Nevertheless, considering heart disease's long-standing position as the leading cause of death in the United States, it is essential to continue efforts to improve population-wide adoption of DASH.

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